Supplementary Material

Estimating use-dependent synaptic gain in autonomic ganglia by computational simulation and dynamic-clamp analysis

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4 text pages

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MODELED CURRENTS

Six ionic currents were used to model the sympathetic B neuron. The equations listed below describe their kinetics and follow from previous work (Yamada et al. 1989; Schobesberger et al. 2000).

Nicotinic synaptic current

$I_{syn}(V, t) = g_{syn}(t)\ (V - E_{syn})$

$g_{syn}(t) = [-\exp\{-(t - t_0) / 1\} + \exp\{-(t - t_0) / 5] / 0.534985$ (EPSG waveform)

Fast inactivating sodium current

$I_{Na}(V, t) = \bar{g}_{Na}\, m^2(V, t)\ h(V, t)\ (V - E_{Na})$

$dm(V, t)/dt = [m_\infty(V) - m(V, t)] / \tau_m(V)$ (activation variable)

$m_\infty(V) = \alpha_m(V) / [\alpha_m(V) + \beta_m(V)]$ (steady-state)

$\tau_m(V) = 2 / [\alpha_m(V) + \beta_m(V)]$ (time constant)

$\alpha_m(V) = [0.36\ (V + 33)] / [1 - \exp\{-(V + 33) / 3\}]$ (forward rate)

$\beta_m(V) = [-0.4\ (V + 42)] / [1 - \exp\{(V + 42) / 20\}]$ (backward rate)

$dh(V, t)/dt = [h_\infty(V) - h(V, t)] / \tau_h(V)$ (inactivation variable)

$h_\infty(V) = \alpha_h(V) / [\alpha_h(V) + \beta_h(V)]$

$\tau_h(V) = 2 / [\alpha_h(V) + \beta_h(V)]$

$\alpha_h(V) = [-0.1\ (V + 55)] / [1 - \exp\{(V + 55) / 6\}]$

$\beta_h(V) = 4.5 / [1 + \exp\{-V / 10\}]$

Non-inactivating delayed-rectifier potassium current

$I_K(V, t) = \bar{g}_K\, n^2(V, t)\,(V - E_K)$

$dn(V, t)/dt = [n_\infty(V) - n(V, t)] / \tau_n(V)$ (activation variable)

$n_\infty(V - 20) = \alpha_n(V - 20) / [\alpha_n(V - 20) + \beta_n(V - 20)]$

$\tau_n(V) = 1 / [\alpha_n(V) + \beta_n(V)]$

$\alpha_n(V) = [0.0047\,(V + 12)] / [1 - \exp\{-(V + 12) / 12\}]$

$\beta_n(V) = \exp\{-(V + 147) / 30\}$

M-type potassium current

$I_M(V, t) = \bar{g}_M\, w(V, t)\,(V - E_M)$

$dw(V, t)/dt = [w_\infty(V) - w(V, t)] / \tau_w(V)$ (activation variable)

$w_\infty(V) = 1 / [1 + \exp\{-(V + 35) / 10\}]$

$\tau_w(V) = 1000 / [3.3\,[\exp\{(V + 35) / 40\} + \exp\{-(V + 35) / 20\}]]$

Cyclic nucleotide-gated cation leak current

$I_{CNG}(V) = g_{CNG}\,(V - E_{CNG})$

Background leak current

$I_{leak}(V) = g_{leak}\,(V - E_{leak})$

REFERENCES

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